

# **MARKET DESIGN AND TESTBEDS: An Aquaculture Application of a A Continuous Combinatorial Ascending Bids Auction**

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April 2016

The government is dissatisfied with the administrative methods it has used to regulate and allocate the rights to water use.

expensive  
time consuming/slow  
economically inefficient  
wastes resources  
leads to complaints  
political pressure

but  
the problems are complex

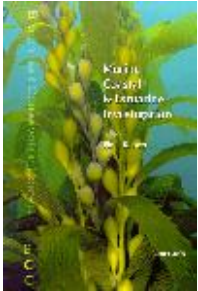


# Leasing and licensing within aquaculture fisheries reserves

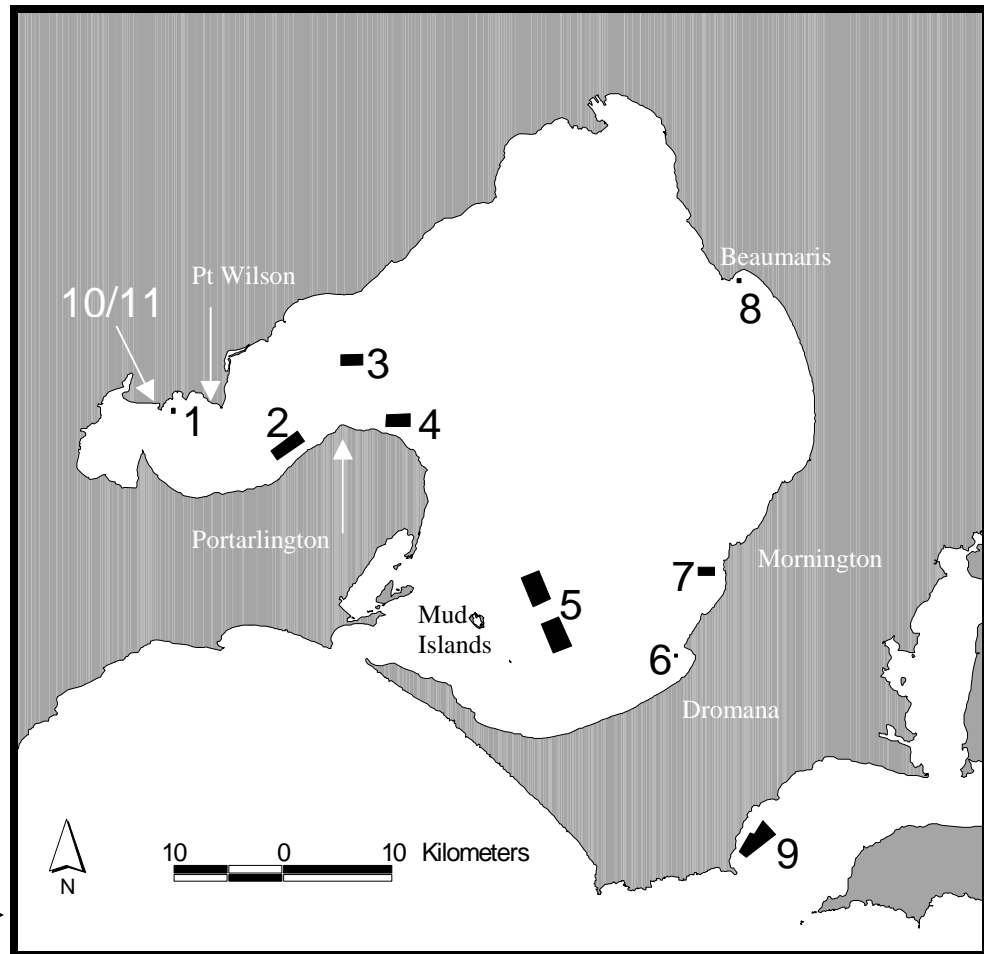
Bruce Gray - Department of Sustainability & Environment  
Anthony Forster - Department of Primary Industries

24/04/2016

# The Aquaculture Zones



- 1 Bates Point (25 ha)
- 2 Clifton Springs (315 ha)
- 3 Kirks Point / Werribee (200ha)
- 4 Grassy Point (252 ha)
- 5 Pinnacle Channel (1000 ha)
- 6 Dromana (20 ha)
- 7 Mount Martha (150 ha)
- 8 Beaumaris (25 ha)
- 9 Flinders (440 ha)
- 10 Point Lillias (40 ha)
- 11 Avalon (17 ha)
- (12 Portland (200 ha))





Beaumaris  
Aquaculture  
Fisheries Reserve

Kirk Point - Werribee  
Aquaculture  
Fisheries Reserve

Port  
Phillip  
Bay

Bates Point  
Aquaculture  
Fisheries  
Reserve

Clifton  
Springs  
Aquaculture  
Fisheries  
Reserve

Grassy Point  
Aquaculture  
Fisheries  
Reserve

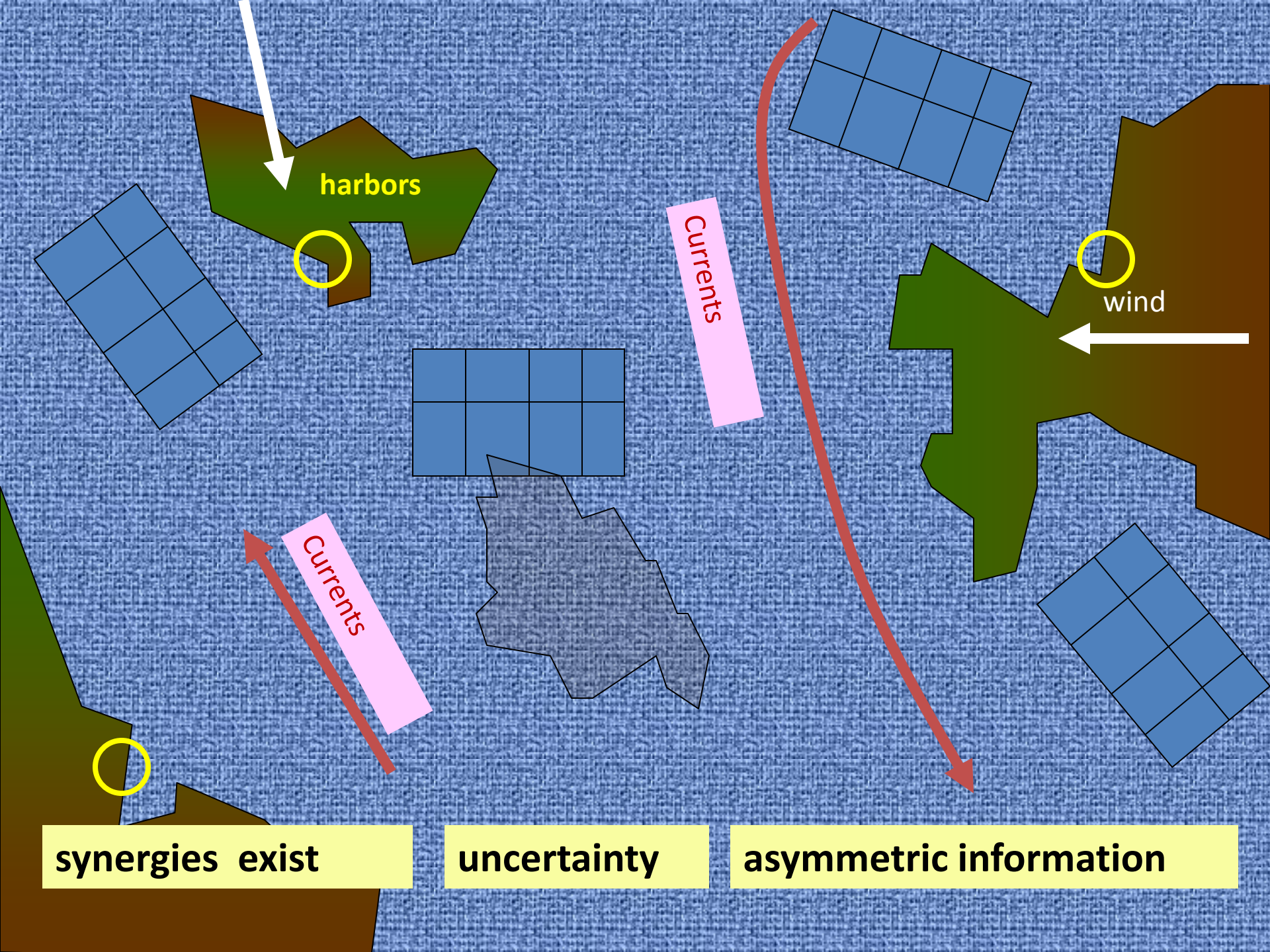
Pinnacle Channel  
Aquaculture  
Fisheries  
Reserve

Mud  
Island

Moorabbin  
Aquaculture  
Fisheries  
Reserve

Dromana  
Aquaculture  
Fisheries  
Reserve





harbors

wind

Currents

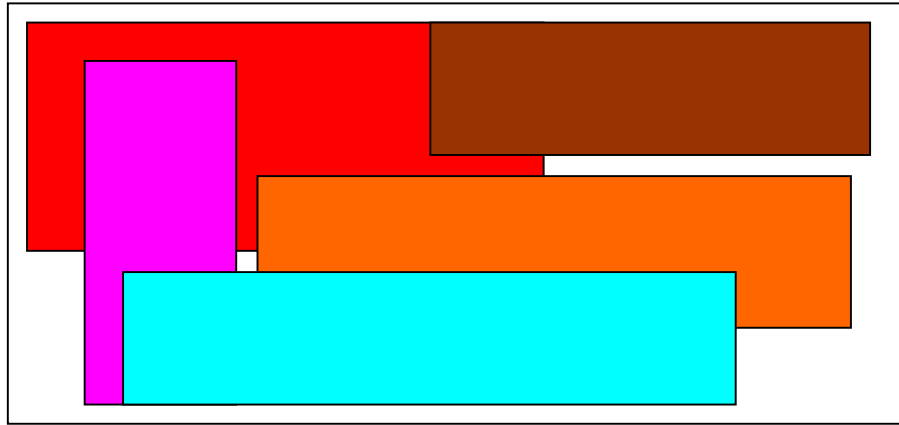
Currents

synergies exist

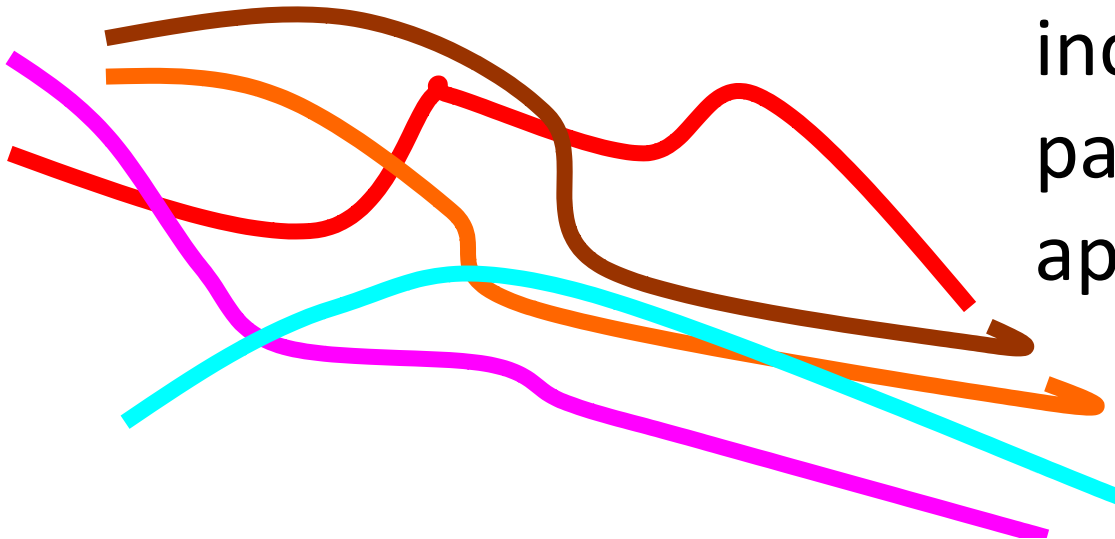
uncertainty

asymmetric information

# BINARY CONFLICT MECHANISMS (BICAP)



Winning packages cannot intersect.



Non intersecting paths and routes, including time parameters, are applications.

# Illustration 1. Bids, Provisional Winners, Clocks

Watch the Clocks

Real Time or  
Paused

View the Offers

(Provisional  
Winners,  
Complete Offer  
List)

Fashion  
Your Offer

The screenshot shows an auction website interface with the following elements:

- Top Bar:** "Auction - Microsoft Internet Explorer" and "PIC: 85".
- Left Panel:**
  - Time Remaining:** "new bid: 00:56", "new winner: 07:56".
  - Price:** "15150", "min 15150", "win 15150".
  - Bid #:** "123".
  - Items:** "123".
  - Buttons:** "remove item", "Clear All", "Show Intersecting Bids", "Submit Offer", "Send Query".
  - Complete Submission Form:** "Watch List Submission Form", "Add Items to Watch List", "Add Items to Bid", "Clear".
  - Offer Modification Form:** "Complete Offer List".
  - Table:** "run number" table with 4 columns and 20 rows. Item 123 is highlighted in red.
- Right Panel:**
  - Provisional Winners:** Table with 4 columns: "run# PIC \$Offer".
  - Watch List:** Table with 4 columns: "run# PIC \$Offer".
  - Complete offer list:** Table with 4 columns: "run# PIC \$Offer".
- Bottom:**
  - Messages:** "Your bid on item 127 for 15000 is now winning", "Your bid on item 123 for 15150 is not winning", "The sale is currently open".
  - Footer:** "An offer of 15150 is required to submit this package", "An offer of 15400 is required to provisionally win this package".



## Illustration 2. Fashion and Submit an Offer

new bid: 00:56 new winner: 07:56 live

Price 15150 - + min 15150 min 15400

Bid #

Items 123

7.

6. Short cut to price selection:

a. Query for amount, b. choose minimum or winning

1. Make sure you are on one of these

[Complete Submission Form](#)  
[Watch List Submission Form](#)

[Offer Modification Form](#)  
[Complete Offer List](#)

5. Choose price

4. Inspect selected before proceeding

2. Select the Item(s)

3. Add selected to your offer

run number			
101	102	103	104
105	106	107	108
109	110	111	112
113	114	115	116
117	118	119	120
121	122	123	124
125	126	127	128
129	130	131	132
133	134	135	136
137	138	139	140
141	142	143	144
145	146	147	201

# Illustration 3. View the Offers (Provisional Winners)

run#, PIC making offer

1. Make sure you are here

**Purple** Provisional Winner of a single

**Blue PIC** Provisional Winner of a package offer

**Black price** high single offer (not winning due to a package offer)

**Gold** means you are the Provisional Winner

Red dot is a new Provisional Winner

Black dot is new non-winning offer

Provisional Winners

run#	PIC	\$Offer
101	12	17850
105	12	15100
109	78	15100
113	12	15000
117	90	15000
121	12	15000
125	12	14950
129	**	15000
133	**	15000
137	13	15000
141	**	15000
145	**	15000
202	78	14450
206	**	14500

Watch List

run#	PIC	\$Offer
102	85	15550
106	89	15550
110	78	15000
114	85	15150
118	85	14950
122	**	15000
126	**	15000
130	**	15000
134	**	15000
138	**	15000
142	**	15000
146	**	15000
203	78	14450
207	**	14500

Complete offer list

run#	PIC	\$Offer
103	12	15050
107	12	15000
111	**	15000
115	**	15000
119	12	15000
123	12	15100
127	85	15000
131	**	15000
135	**	15000
139	**	15000
143	**	15000
147	**	15000
204	**	14500
208	**	14500

102 85 15550

106 89 15550

110 78 15000

114 85 15150

118 85 14950

122 \*\* 15000

126 \*\* 15000

130 \*\* 15000

134 \*\* 15000

138 \*\* 15000

142 \*\* 15000

146 \*\* 15000

203 78 14450

207 \*\* 14500

## Illustration 4. Ending the Auction

Watch the clocks

Each new bid resets the new bid clock to three minutes (unless otherwise announced).

Each new Provisional Winner resets the new winner clock to ten minutes (unless otherwise announced).

The auction ends when either the new bid clock or the new winner clock counts down to zero. Time on both clocks means that the auction is still open for bidding on all items.

When the auction ends the Provisional Winners become the Auction Winners.

PIC: .

**Provision**

run#	PI
101	3
105	3
109	7
113	4
117	3
121	3
125	2
129	2
133	*
137	1
141	1
145	*
202	7

**WM**

Time Remaining.

new bid: 02:56      new winner: 09:56      **live**

Price  +  min  win

Bid #  Show Bid as Winning

Items

remove item      Clear All      Show Intersecting Bids

Submit Offer      Send Query

Complete Submission Form      Offer Modification Form  
Watch List Submission Form      Complete Offer List

Add Items to Watch List      Add Items to Bid      Clear

run number

## Illustration 5. Offer Management ([Offer Modification form](#))

The screenshot shows the Offer Management interface. At the top, there's a header with 'new bid: 00:00', 'new winner: 00:00', and a 'paused' status. Below this, there's a form for entering bid details: 'Price' (48300), 'Bid #1266', and 'Items' (101, 103, 106). There are buttons for 'min', 'win', 'Show Bid as Winning', 'remove item', 'Clear All', and 'Show Intersecting Bids'. A 'Submit Offer' button is also present.

Annotations and steps:

- 1. Make sure you are here**: Points to the top header area.
- 2. Cancel a non Provisional Winning offer:**
  - a. Select the offer
  - b. Cancel Selected: Points to the 'Cancel Selected Bids' button at the bottom of the 'My Bids' table.
- 3.1 Modify an offer: a. Select the offer**: Points to the 'modify' column in the 'My Bids' table.
- 3.2 Modify an offer:**
  - b. Select a new price or c. Change package
  - d. Submit Offer: Points to the 'Submit Offer' button.
- 4. Return to [Offer Submission Form](#)**: Points to the 'Offer Submission Form' link.

**My Bids Table:**

bid#	price	items	modify
1279	15000	127	<input type="radio"/>
1278	15100	123	<input type="radio"/>
1267	15100	105	<input type="radio"/>
1266	45800	102 114 118	<input type="radio"/>
1265	48300	101 103 106	<input type="radio"/>
<b>total</b>	<b>60800</b>		

Buttons at the bottom: 'Cancel Selected Bids', 'Clear'.

**Total dollars for your provisional winners**: Points to the 'total' row in the 'My Bids' table.

## Illustration 6. View the Offers ([Complete Offer List](#))

1. Make sure you are here

2. Return to [Provisional Winners](#) screen

[Complete Offer List](#)

[Provisional Winners](#)  
[Watch List](#)

PIC of bidder making the offer,  
Bid number, Offer price,  
Items in offer,  
Time entered

PIC	bid#	price	items	time entered
86	1280	15000	141	Sat Jun 22 08:07:35 2002
85	1279	15000	122	Sat Jun 22 07:41:23 2002
85	1278	15100	123	Sat Jun 22 00:40:45 2002
73	1277	15000	137	Fri Jun 21 14:17:05 2002
12	1276	15000	119	Wed Jun 19 21:09:28 2002
12	1275	80458	104 107 113 121	Wed Jun 19 21:05:52 2002
12	1274	78400	101 105 123 124 125	Wed Jun 19 21:05:00 2002
12	1273	15050	103	Wed Jun 19 21:03:34 2002
11	1272	15000	107	Wed Jun 19 20:40:09 2002
90	1271	15000	117	Wed Jun 19 19:51:30 2002
89	1270	15550	106	Wed Jun 19 19:13:04 2002
88	1269	60950	106 108 121 123	Wed Jun 19 15:42:15 2002
88	1268	60600	106 108 121 123	Wed Jun 19 15:41:40 2002
85	1267	15100	105	Wed Jun 19 09:46:51 2002
85	1266	45800	102 114 118	Wed Jun 19 09:30:27 2002
85	1265	48300	101 103 106	Wed Jun 19 09:27:50 2002
78	1264	44300	112 202 203	Tue Jun 18 18:52:52 2002
78	1263	15550	102	Tue Jun 18 18:48:35 2002
78	1262	45500	102 103 112	Tue Jun 18 18:47:27 2002
78	1261	29150	202 203	Tue Jun 18 18:46:02 2002
78	1260	43500	202 203 205	Tue Jun 18 18:40:16 2002
78	1259	58000	202 203 204 205	Tue Jun 18 18:36:16 2002
78	1258	30200	109 110	Tue Jun 18 18:31:53 2002

Gold

You are  
Provisional Winner

Yellow

White

Provisional Winner

Currently non  
Provisional Winner

# Illustration 7. Strategy Tools

1. Select item(s)

2. Add selected to offer

Show Bid as Winning

4. Return to [Provisional Winners](#) Screen

3. Show as Winning

new bid: 00:00 new winner: 00:00 **paused**

Price 43250 - + min win

Bid #

Items 109 113 117

remove item Clear All Show Intersecting Bids

Submit Offer Send Query

[Complete Submission Form](#) [Watch List Submission Form](#) [Offer Modification Form](#) [Complete Offer List](#)

Add Items to Watch List Add Items to Bid Clear

run number			
101	102	103	104
105	106	107	108
109	110	111	112
113	114	115	116
117	118	119	120
121	122	123	124
125	126	127	128

Your offer if submitted

This offer remains a Provisional Winner

Your offer bumps them

Offer was out and remains out

A partner used to bump packages with your offer

Query Results: 110 114 123 127

run#	PIC	\$Offer	run#	PIC	\$Offer	run#	PIC	\$Offer	run#	PIC	\$Offer
101	76	17850	102	78	15550	103	12	15050	104	12	15150
105	85	15100	106	89	15550	107	12	15000	108	78	15150
109	76	15100	110	--	13000	111	100	14950	112	78	15000
113	12	15000	114	--	15150	115	100	14950	116	100	14950
117	90	15000	118	100	14950	119	71	15000	120	71	14950
121	12	15000	122	100	14950	123	--	15100	124	71	15000
125	100	14950	126	100	14950	127	--	13000	128	100	14950
129	100	14950	130	100	14950	131	100	14950	132	100	14950

PIC	bid#	price	items	time entered
85	1280	15000	110 114 123 127	Sat Jun 22 08:07:35 2002
85	1279	15000	127	Sat Jun 22 00:41:23 2002
85	1278	15100	123	Sat Jun 22 00:40:45 2002
13	1277	15000	137	Fri Jun 21 14:17:05 2002
12	1276	15000	119	Wed Jun 19 21:09:28 2002
12	1275	60450	104 107 113 121	Wed Jun 19 21:05:52 2002
12	1274	78400	101 105 123 124 125	Wed Jun 19 21:05:00 2002
12	1273	15050	103	Wed Jun 19 21:03:34 2002
11	1272	15000	107	Wed Jun 19 20:40:09 2002
90	1271	15000	117	Wed Jun 19 19:51:30 2002
89	1270	15550	106	Wed Jun 19 16:13:04 2002
88	1269	60950	106 108 121 123	Wed Jun 19 15:42:15 2002
88	1268	60600	106 108 121 123	Wed Jun 19 15:41:40 2002
85	1267	15100	105	Wed Jun 19 09:46:51 2002
85	1266	15500	102 114 118	Wed Jun 19 09:30:07 2002



## Testbeds

Financial incentives

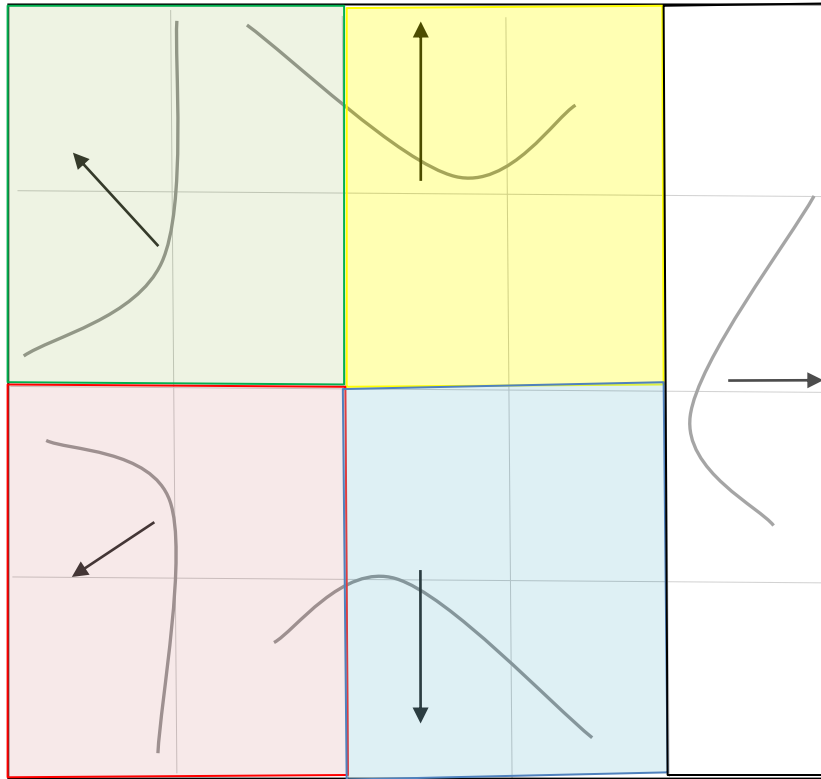
Maximum efficiency known to experimenter

Problem complexity is controlled

Human errors and mistake potentials studied

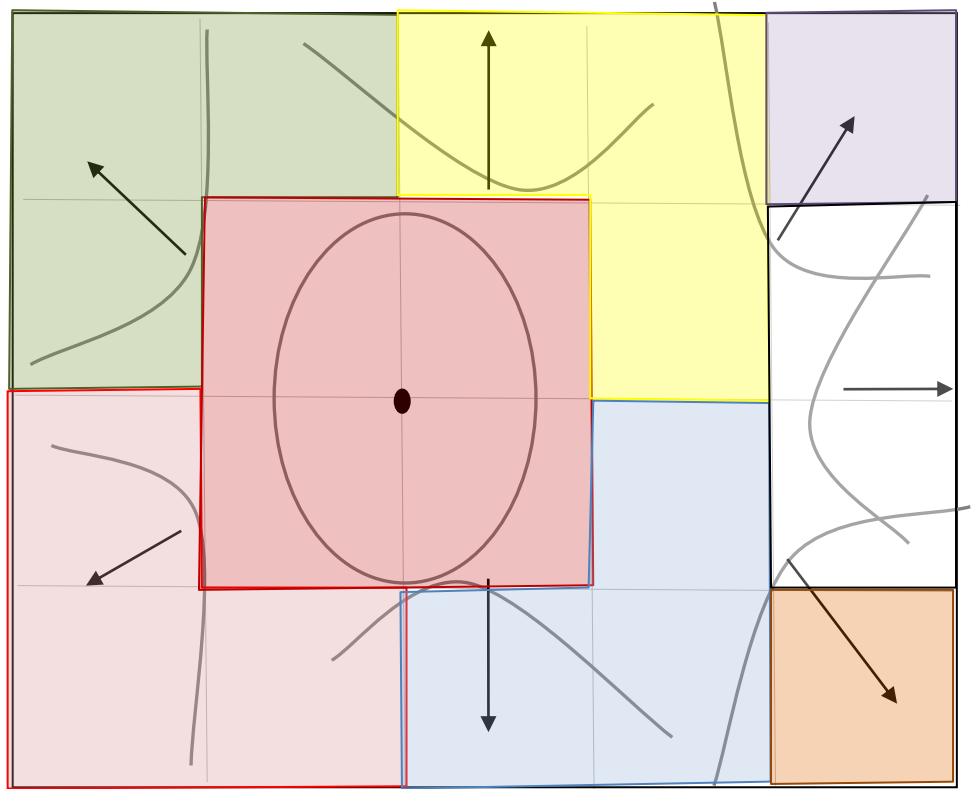
Experiments involve increasing scale

**Figure 1 relatively easy  
parameters**



**16 items 5 bidders  
Optimal allocation  
shown**

**Figure 2 relatively hard  
parameters**

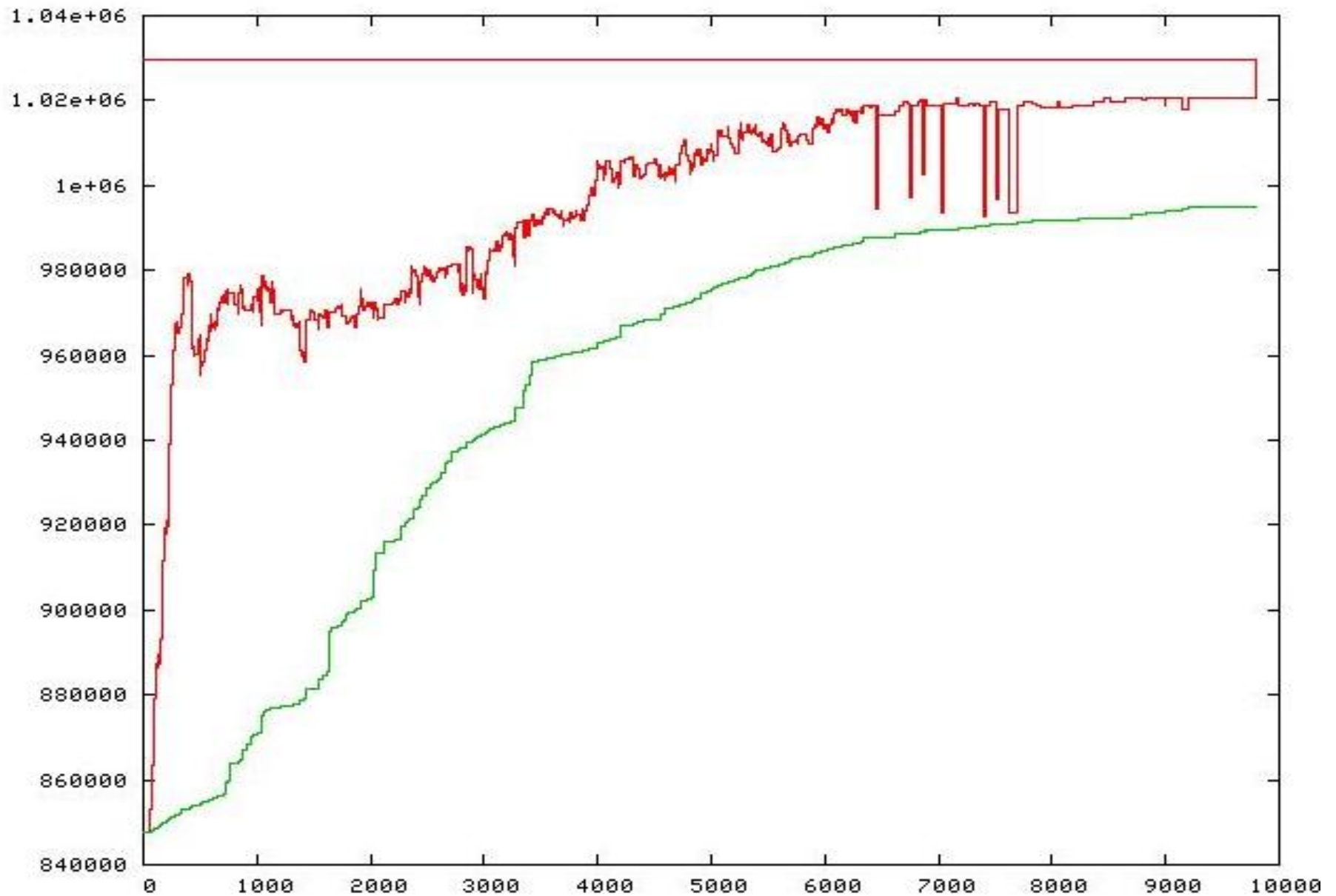


**16 items 8 bidders  
Optimal allocation  
shown**

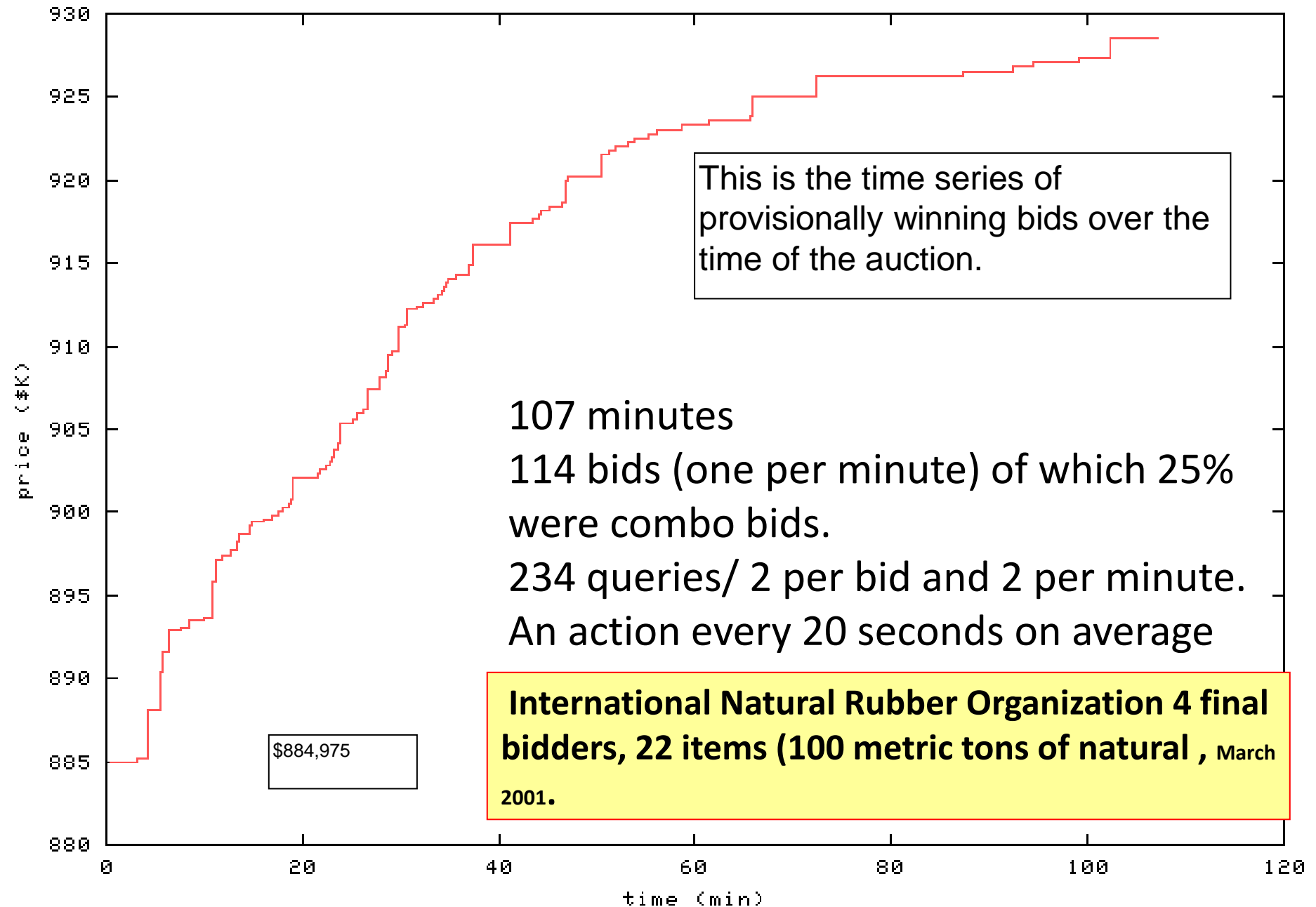
**Table 1: Data**

DATA	Number of bidders	Efficient allocation value	Actual allocation value	Efficiency	note: experimental parameters
060411A	5	14296	14296	100%	easy
060411B	5	14296	14296	100%	easy
060517A	5	14926	14926	100%	easy
060519A	5	14296	14296	100%	easy
060519B	5	14296	14296	100%	easy
060511	8	10000	10000	100%	hard
060524	8	10000	10000	100%	hard
060525A	8	10000	8550	85.5%	hard –A person bought almost all – lost money
060525B	8	10000	6900	69%	hard – A key person bought only 1 and lost money on it.
					The two poor formers are included as examples that demonstrate the nature of the insights produced by testbed experiments.

50 items 30 bidders

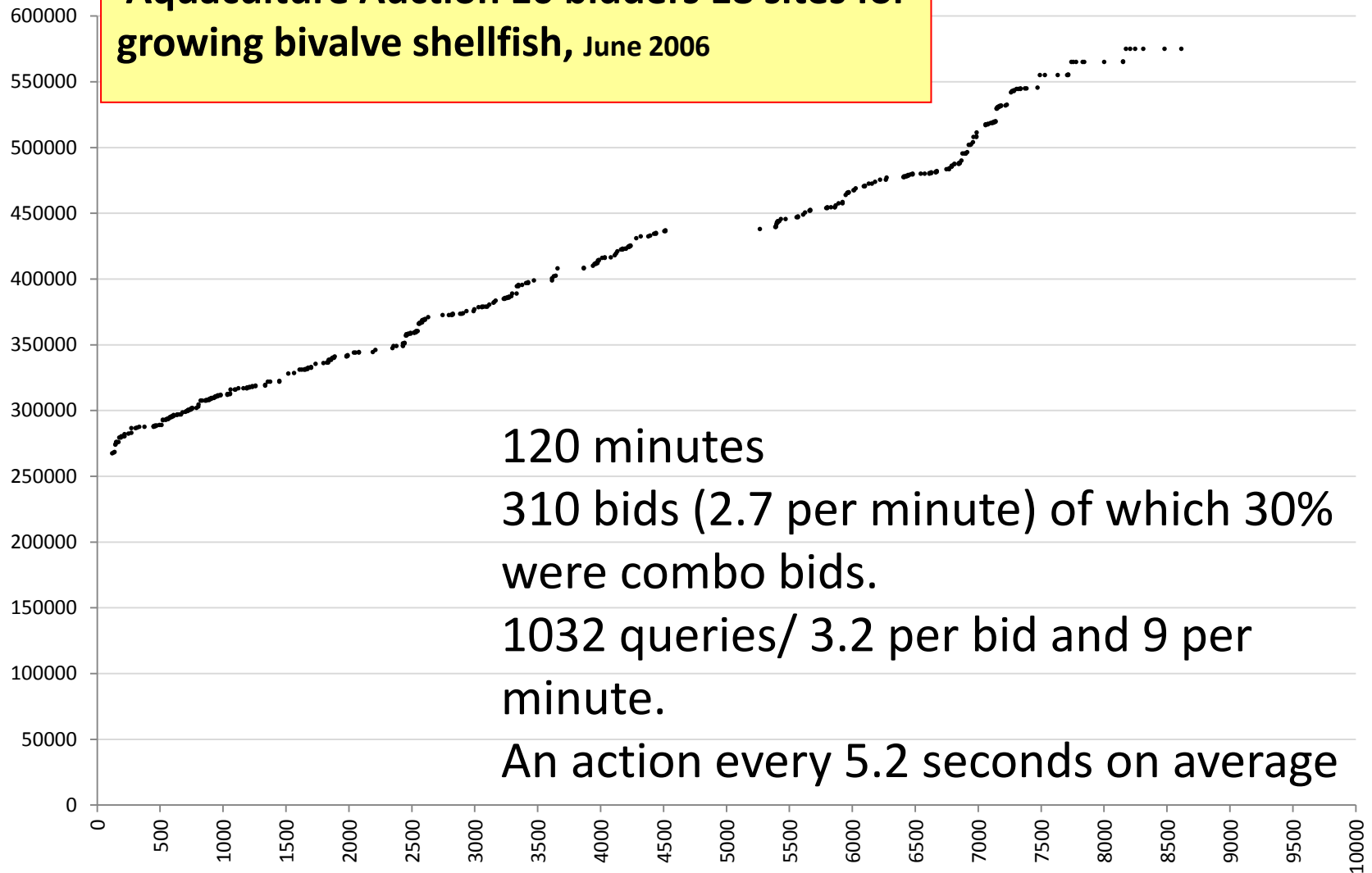


## INRO Auction



## Revenue Aquaculture

**Aquaculture Auction 10 bidders 18 sites for growing bivalve shellfish, June 2006**





VICTORIA

Using a new allocation method such as an electronic combinatorial auction to allocate resources clearly presented some risks for the Department. However, I am assured that your professionalism and your experience played a big part in minimising these risks, and for that I am grateful. The success of this auction will pave the way for use of other competitive allocation methods in the future, both within the Department and possibly across other Victorian Government Departments.

Since auction day, I have been informed that many bidders (both winners and non-winners) complimented the Department on the fairness and user-friendly nature of the auction system. I am not aware of any complaints regarding the difficulty of the auction system.

Thank you for a job well done. I hope that you will offer your services to us again in the future.

Yours sincerely,



PETER HARRIS  
Secretary



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*Thank  
You*



Design skills differ from skills useful for participants.  
In order to use it you do not need to know how it works.



**Some participants are more skillful than others.**